

REMARKS

Claims 1-10 are pending in the present application. Claims 1-10 are rejected. No claims are amended, and no new matter has been entered.

Claim Rejections - 35 U.S.C. §103

Claims 1-10 are rejected under 35 U.S.C. §103(a) as being unpatentable over US 6,300,654 to Corvasce et al. in combination with US 6,444,099 to Sasaki et al., and further in view of US 6,964,873 to Matsuura et al., “Preferred Orientation in Ti Film Sputter - Deposited on SiO₂ Glass: The Role of Water Chemisorption on the Substrate” to Ohwaki et al. and US 6,716,749 to Noguchi et al.

With respect to claim 1, the Examiner admits that Corvasce et al. does not disclose keeping substrate in the claimed range of higher than room temperature and lower than 300 °C while forming a Ti lower layer of a lower-electrode conductive film on the insulating film. The Examiner asserts that Sasaki et al. does teach temperatures of 200 °C or 300 °C.

The Examiner concludes that it would have been obvious to provide the method in Corvasce et al. with the Ti sputtering while keeping substrate temperature higher than room temperature and lower than 300 °C because the Ti sputtering of Sasaki et al. would provide the method of Corvasce et al. with prevention of “a problem with collimation sputtering is that sputter particles accumulate on the collimator portion, and the resulting loss of material decreases the deposition rate” (Sasaki et al. column 2, lines 5-10).

Applicants respectfully disagree with this asserted suggestion to combine the references to reach the present invention. Applicants note that Sasaki et al. does not teach that the exact temperatures of 200 °C or 300 °C solve the asserted problem of decrease of deposition rate. Rather, Sasaki et al. teaches the use of ionizing sputtering, rather than collimation sputtering, to achieve its solution. Such ionizing sputtering is carried out at the temperature of temperatures of 200 °C or 300 °C in Sasaki et al. Therefore, if one skilled in the art combined the above two references, one would use ionizing sputtering at a minimum temperature of 350 °C, which is still outside the claimed invention. The only way to reach the presently claimed invention is for the Examiner to pick and choose various parameters from the references outside of the context in which they are disclosed (i.e., the method of Corvasce et al. and the temperatures of Sasaki et al.). Such picking and choosing amounts to an improper obviousness rejection.

The Examiner further admits that the above combination does not teach crystal orientation or water added during sputtering. The Examiner notes that Matsuura et al. discloses the importance of crystal orientation on column 7, lines 34-50 and col. 3 lines 38-52, where Matsuura et al. recites that "...it is known that the ferroelectric properties of a PZT or PLZT film is related to the orientation of the PZT or PLZT crystals constituting the film. Commonly, a predominately (111) or (100)-orientation is obtained for a PZT or PLZT film formed on a Pt lower electrode, which has a self-textured (111)-orientation (re claim 6), due to the epitaxial effect, in which the surface energy is minimized as a result of the foregoing film orientation."

The Examiner asserts that one of ordinary skill in the art would have been led to the recited temperature of higher than room temperature and lower than 300 °C while forming Ti

lower layer through routine experimentation to achieve desired deposition and reaction rates. The Examiner concludes that it would have been obvious to have provided the method of Corvasce et al. with the conditions of Ohwaki et al. and /or Matsuura et al. because the conditions of Ohwaki et al. and/or Matsuura et al. would provide the ferroelectric capacitor of Corvasce et al. with the Ti (002) preferred orientation for the reliability of the electrode (Ohwaki et al.) and with better adhesion (Matsuura et al.).

Applicants respectfully disagree with the above conclusion. The Examiner asserts that the conditions of Ohwaki et al. would provide the ferroelectric capacitor of Corvasce et al. with the Ti (002) preferred orientation for the reliability of the electrode. However, the conditions of Ohwaki et al. that are needed to achieve the preferred (002) orientation are the triple conditions of

- (1) a temperature of 350 °C,
- (2) at least some content of water, and
- (3) content of water is introduced when the substrate has reached 350 °C.

That is, it is not merely an atmosphere containing water vapor, but a minimum temperature of 350 °C. Therefore, adding the “conditions” of Ohwaki et al. to Corvasce et al. would result in the process of Corvasce et al. being conducted in a vapor atmosphere at a temperature of 350 °C, which is outside the claimed temperature range.

Furthermore, Applicants note that the “conditions” of Matsuura et al. amount to a deposition of a Ti adhesion layer at room temperature, followed by annealing at 600 °C or above.

Thus, the deposition temperature of Matsuura et al. is outside the claimed minimum temperature of “higher than room temperature.”

With respect to claim 9, the Examiner admits that the above combination does not disclose the improvement of the insulating film before forming further the device. The Examiner concludes that it would have been obvious to provide the process of the combination with step of NH₃ plasma nitridation before the lower layer of the lower-electrode conductive film is formed because Noguchi et al. teaches that the plasma nitridation would improve the surface of the insulating film.

Applicants respectfully disagree with the above rejection because the base independent claim 1 has already been differentiated. Because claim 9 depends from and necessarily includes at least the limitations of claim 1, claim 9 is similarly distinguished.

Further to the above, Applicants submit that even if the references were properly combined and if the obviousness rejection had merit, Applicants note that the recited temperatures range produces unexpected results, as noted in Fig. 2. Applicants note that the Inventors discussed this in the specification on page 21, final paragraph, which indicates that

“As shown in FIG. 2, it is understood that the orientation of the Ti film is smallest in the case where the substrate temperature is room temperature (20 °C) and that the degree of orientation also increases as the substrate temperature increases beyond room temperature. However, the degree of orientation turns into a downward trend after becoming maximum at around 150 °C. It can be seen by extending the graph that the degree of

orientation at around 300 °C becomes almost the same as that at room temperature. These show that the degree of orientation of a Ti film in the (002) direction can be improved by setting the substrate temperature during the deposition of the Ti film higher than room temperature and lower than 300 °C.” Therefore, it was the opinion of the Inventors at the time the invention was made that Fig. 2 could be extrapolated to show that a temperature of no more than 300 °C was necessary to produce the invention.

Applicants submit that the unexpected results noted above should be sufficient to rebut any properly made *prima facie* rejection for obviousness.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants’ undersigned attorney to arrange for an interview to expedite the disposition of this case.

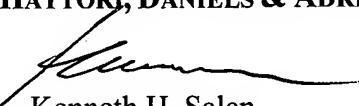
Application No. 10/772,253
Attorney Docket No. 042068

Response under 37 C.F.R. §1.111
Response filed: June 19, 2006

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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